



GCE AS/A LEVEL

2400U10–1

MONDAY, 13 MAY 2024 – MORNING

BIOLOGY – AS UNIT 1

**BASIC BIOCHEMISTRY
AND CELL ORGANISATION**

**1 hour 30 minutes plus your additional
time allowance**

Surname: _____

First Name(s): _____

Centre Number: _____

Candidate Number: 2 _____

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	10	
2.	10	
3.	14	
4.	16	
5.	9	
6.	12	
7.	9	
Total	80	

(Turn over)

ADDITIONAL MATERIALS

A calculator and a ruler.

**ITEMS INCLUDED WITH QUESTION
PAPER**

A separate Diagram Booklet.

**The Diagram Booklet MUST be handed in
to the invigilators and sent for marking.**

(Turn over)

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball – point pen, black felt tip or your usual method.

Write your name, centre number and candidate number in the spaces on the front cover.

Answer ALL questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

(Turn over)

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part – question.

The assessment of the quality of extended response (QER) will take place in question 7.

The quality of written communication will affect the awarding of marks.

(Turn over)

Answer ALL questions.

- 1. Refer to IMAGE 1.1 in the separate Diagram Booklet. IMAGE 1.1 shows diagrams of two different cells. Scale bars are shown to illustrate the relative sizes of the cells.**
 - (a) Both cells produce the enzyme RNA polymerase. This is involved in the production of mRNA which is needed for translation by ribosomes.**

continued on the next page . . .

(Turn over)

Question 1 (a) continued

- (i) State the names of TWO other types of RNA involved in protein synthesis.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 1 (a) continued

- 1. (a) (ii) Using your knowledge of cell structure, fill in the spaces below to compare the sites of translation and size of ribosomes in the two cells.**

BACTERIAL CELL

location(s) of ribosomes involved in translation

= _____

ANIMAL CELL

location(s) of ribosomes involved in translation

= _____

continued on the next page . . .

(Turn over)

Question 1 (a) continued**BACTERIAL CELL****size of ribosome****=**

ANIMAL CELL**size of ribosome****=**

[2 marks]**continued on the next page . . .****(Turn over)**

- 1. (b) Both cells contain membranes.
The animal cell has considerably
more membrane than the bacterial
cell.**

**Use IMAGE 1.1 and your
knowledge of the structure of
these cells to suggest TWO
reasons for this difference.**

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 1 continued

1. (c) Refer to IMAGE 1.2 in the separate Diagram Booklet. IMAGE 1.2 shows the cell surface membrane of the animal cell.

(i) Identify components A and B in IMAGE 1.2 and describe their functions.

A _____

(Turn over)

B

[3 marks]

continued on the next page . . .

(Turn over)

Question 1 (c) continued

- 1. (c) (ii) The components labelled C in IMAGE 1.2 form the glycocalyx and are involved in cell recognition. The cell surface membranes of the animal cell have a different composition from the inner mitochondrial membrane. The percentage composition of the three components in each membrane is shown in TABLE 1.3 provided in the separate Diagram Booklet.**

continued on the next page . . .

(Turn over)

Question 1 (c) (ii) continued

**Using the information in
TABLE 1.3 and your
knowledge of the function of
plasma membranes, suggest
why there is:**

**I. no component C in the
inner mitochondrial
membrane;**

[1 mark]

continued on the next page . . . (Turn over)

Question 1 (c) (ii) continued

- 1. (c) (ii) II. more component B in the
inner mitochondrial
membrane than the cell
surface membrane.**

[1 mark]

(Total for Question 1 = 10 marks)

(Turn over)

2. Nucleotides are involved in cell metabolism. Refer to the IMAGE 2.1 in the separate Diagram Booklet. Three nucleotides are shown in IMAGE 2.1.

(a) (i) State THREE structural similarities between all three nucleotides shown in IMAGE 2.1

[1 mark]

continued on the next page . . .

(Turn over)

Question 2 (a) continued

- 2. (a) (ii) Refer to TABLE 2.2 in the separate Diagram Booklet. Complete TABLE 2.2 to describe ONE structural difference between each of the pairs of nucleotides shown.**
- (iii) Name TWO inorganic ions needed by plant cells in order to synthesise the molecules shown in IMAGE 2.1**
-
-

[1 mark]

continued on the next page . . .

(Turn over)

Question 2 continued

- 2. (b) (i) Each human body cell contains 2.6×10^{-11} g of nucleic acid, of which approximately 2.0×10^{-11} g is RNA.**

Calculate the percentage of nucleic acid that is RNA in a human cell.

GIVE YOUR ANSWER TO ONE DECIMAL PLACE.

Answer space continues on the next page.

(Turn over)

Question 2 (b) (i) continued

Percentage of nucleic acid that is RNA

= _____

[2 marks]

continued on the next page . . .

(Turn over)

Question 2 (b) continued

- 2. (b) (ii) Explain why the percentage of nucleic acid that is RNA in a human cell is variable.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 2 continued

- 2. (c) Refer to IMAGE 2.3 in the separate Diagram Booklet. IMAGE 2.3 shows how ATP is used in a cell.**

Use IMAGE 2.3 to explain how ATP is used in cells AND state why it is described as the UNIVERSAL ENERGY CURRENCY.

(Turn over)

[3 marks]

(Total for Question 2 = 10 marks)

(Turn over)

3. Hydrogen peroxide is a product of respiration and is made in all cells. It is harmful and therefore removed as soon as it is produced. Catalase is an intracellular enzyme that converts hydrogen peroxide into water and oxygen.

(a) Hydrogen peroxide decomposes slowly without catalase.

Explain how catalase speeds up the decomposition AND suggest why this is so important in living cells.

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 3 continued

- 3. (b) Some students investigated how the concentration of hydrogen peroxide affected the rate of oxygen production. They used fresh potato puree and different concentrations of hydrogen peroxide.**

The apparatus was set up as shown in IMAGE 3.1 in the separate Diagram Booklet.

continued on the next page . . .

(Turn over)

Question 3 (b) continued

- **A measuring cylinder was used to measure 20 cm^3 potato puree which was poured into the conical flask.**
- **A 50 cm^3 measuring cylinder was filled with water and inverted over the open end of the delivery tube.**
- **2 cm^3 of 5.0 vol hydrogen peroxide was drawn up into the syringe and attached to the apparatus in the position shown.**
- **The plunger was pushed in and a timer was started immediately.**

continued on the next page . . .

(Turn over)

Question 3 (b) continued

- **After 30 seconds the volume of oxygen collected was measured using the scale on the measuring cylinder and recorded.**
- **The rate of oxygen production in $\text{cm}^3 \text{s}^{-1}$ was calculated.**
- **The experiment was repeated using 3.5 vol, 2.0 vol, 1.5 vol, 1.0 vol and 0 vol hydrogen peroxide.**

The results are shown in TABLE 3.2 in the separate Diagram Booklet.

continued on the next page . . .

(Turn over)

Question 3 (b) continued

- 3. (b) (i) Calculate the rate of oxygen production in $\text{cm}^3 \text{s}^{-1}$ for 1.5 VOL HYDROGEN PEROXIDE, TO ONE DECIMAL PLACE, and WRITE YOUR ANSWER IN TABLE 3.2**

[2 marks]

continued on the next page . . .

(Turn over)

Question 3 (b) continued

- 3. (b) (ii) Refer to GRAPH 3.3 in the separate Diagram Booklet. Use the data from TABLE 3.2 to complete GRAPH 3.3 to show the rate of oxygen production against the concentration of hydrogen peroxide.**

[4 marks]

- (iii) Describe AND explain the trend shown in GRAPH 3.3**

(Turn over)

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[3 marks]

continued on the next page . . .

(Turn over)

Question 3 (b) continued

3. (b) (iv) Suggest TWO ways in which the validity of the data could be improved.

[2 marks]

- 3. (b) (v) Copper sulfate is a non-competitive inhibitor of catalase. On GRAPH 3.3 DRAW A LABELLED LINE to show how the result would be different if the experiment was repeated in the presence of copper sulfate.**

[1 mark]

(Total for Question 3 = 14 marks)

(Turn over)

4. (a) Different structural isomers of glucose are found in polysaccharides with very different properties. Parts of two polysaccharides (A and B) which are found in plants are shown in IMAGE 4.1 in the separate Diagram Booklet.

(i) State what is meant by the term structural isomer.

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 (a) continued

- 4. (a) (ii) Refer to TABLE 4.2 in the separate Diagram Booklet. Complete TABLE 4.2 to describe the structure and function of the polysaccharides A and B, found in plants.**

[6 marks]

continued on the next page . . .

(Turn over)

Question 4 (a) continued

4. (a) (iii) Polysaccharide A is hydrolysed by an enzyme which results in production of the disaccharide shown in IMAGE 4.3 in the separate Diagram Booklet.

State the meaning of the term hydrolysis AND name the disaccharide shown in IMAGE 4.3

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 4 continued

- 4. (b) Refer to IMAGE 4.4 in the separate Diagram Booklet. Gentiobiose, shown in IMAGE 4.4 is a disaccharide which consists of two glucose monomers joined by a β -1,6-glycosidic bond.**

Identify ONE structural similarity and TWO structural differences in the disaccharides shown in IMAGES 4.3 and 4.4

continued on the next page . . .

(Turn over)

Question 4 (b) continued

Structural similarity _____

Structural difference 1 _____

Structural difference 2 _____

[3 marks]

continued on the next page . . .

(Turn over)

Question 4 continued

- 4. (c) Monosaccharides and disaccharides are polar molecules, they are soluble in water.**

Refer to IMAGE 4.5 in the separate Diagram Booklet. IMAGE 4.5 shows some water molecules and their bonds.

- (i) ANNOTATE IMAGE 4.5, to show the polarity of a water molecule.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 (c) continued

- 4. (c) (ii) With reference to IMAGES 4.3, 4.4 and 4.5, explain why monosaccharides and disaccharides are soluble in water.**

[1 mark]

continued on the next page . . .

(Turn over)

Question 4 (c) continued

**4. (c) (iii) State why it is important to
plants that sugars are soluble.**

[2 marks]

(Total for Question 4 = 16 marks)

(Turn over)

5. The Human Immunodeficiency Virus (HIV) was identified in the 1980s. It targets cells called lymphocytes which are part of the immune system. Refer to IMAGE 5.1 in the separate Diagram Booklet. Image 5.1 shows a diagram of HIV.

- HIV contains reverse transcriptase, an enzyme involved in viral RNA replication.**
- RNA and reverse transcriptase are contained within a capsid which is surrounded by a viral envelope.**
- The viral envelope contains a phospholipid bilayer.**

continued on the next page . . .

(Turn over)

Question 5 continued

- **Glycoproteins, projecting from the viral envelope, allow the virus to infect lymphocytes.**

5. (a) (i) Use your knowledge of the one gene one polypeptide hypothesis and IMAGE 5.1 to identify the MINIMUM number of genes within the viral RNA.

Explain your answer.

(Turn over)

[3 marks]

continued on the next page . . .

(Turn over)

Question 5 (a) continued

5. (a) (ii) Use your knowledge of viral structure to give TWO reasons why HIV cannot reproduce without infecting a host cell.

[2 marks]

continued on the next page . . .

(Turn over)

Question 5 continued

5. (b) Refer to IMAGE 5.2 in the separate Diagram Booklet. IMAGE 5.2 shows how HIV infects a human cell and makes copies of itself.

(i) Assuming the virus is spherical and that the diameter of HIV across the viral envelope is 120 nm, use the formula below to calculate the surface area of HIV.

Surface area of a sphere = $4\pi r^2$

$\pi = 3.14$

Answer space continues on the next page.

(Turn over)

Question 5 (b) (i) continued

Surface area = _____ nm²

[2 marks]

continued on the next page . . .

(Turn over)

Question 5 (b) continued

- 5. (b) (ii) With reference to IMAGE 5.2 state the names of the processes occurring at A and B. Explain the effect each process has on the total surface area of the infected cell.**

(Turn over)

50

[2 marks]

(Total for Question 5 = 9 marks)

(Turn over)

6. Refer to IMAGE 6.1 in the separate Diagram Booklet. IMAGE 6.1 shows a eukaryotic cell undergoing mitosis. Different structures have been stained with different fluorescent dyes.

(a) (i) On IMAGE 6.1 name the origin of the spindle fibres, labelled X.

[1 mark]

(ii) I. Name the stage of mitosis shown in IMAGE 6.1

Explain your reasoning.

(Turn over)

[2 marks]

continued on the next page . . .

(Turn over)

Question 6 (a) (ii) continued

6. (a) (ii) II. In the space below DRAW A LABELLED DIAGRAM of ONE CHROMOSOME as it would appear at this stage of mitosis. Your diagram should have TWO labels.

Answer space continues on the next page.

(Turn over)

Question 6 (a) (ii) (II) continued

[2 marks]

continued on the next page . . .

(Turn over)

Question 6 continued

- 6. (b) The mitotic spindle is formed at the start of mitosis, it is made up of many small polypeptides called tubulin which are found in the cytoplasm of eukaryotic cells. Before cell division, microtubules must be assembled from the tubulin polypeptides which join together to form microtubules as shown in IMAGE 6.2 in the separate Diagram Booklet.**

continued on the next page . . .

(Turn over)

Question 6 (b) continued

- 6. (b) (i) Use the information provided to state the highest level of protein structure shown by the microtubule in IMAGE 6.2 Explain your answer.**

[2 marks]

continued on the next page . . .

(Turn over)

Question 6 (b) continued

- 6. (b) (ii) Colchicine is a chemical which prevents the polymerisation of tubulin to form microtubules. Suggest how this would affect the growth of organisms. Explain your answer.**

(Turn over)

[3 marks]

continued on the next page . . .

(Turn over)

Question 6 continued

- 6. (c) Refer to IMAGE 6.3 in the separate Diagram Booklet. When bacteria reproduce, they undergo a process called binary fission. This is shown in IMAGE 6.3**

Use IMAGE 6.3 and your knowledge of eukaryotic cell division to give TWO reasons why cell division in bacteria is not referred to as mitosis.

(Turn over)

60

[2 marks]

(Total for Question 6 = 12 marks)

(Turn over)

- 7. A student carried out an experiment to investigate osmosis in plant tissues. The student used the same volume of sucrose solutions of different concentrations. Pieces of potato and sweet potato were weighed, added to each sucrose concentration and left for 20 minutes. The change in mass was recorded and the percentage change in mass calculated then plotted on a graph as shown in GRAPH 7 in the separate Diagram Booklet.**

continued on the next page . . .

(Turn over)

Question 7 continued

Use your knowledge of osmosis, describe and explain the general trend of the data plotted in GRAPH 7

Use information from GRAPH 7 to explain why there is a difference between the data for potato and sweet potato.

Give a description of the expected results if animal tissue was used instead of plant tissue and explain why the results might be different.

(Turn over)

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This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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(Turn over)

[9 QER marks]

(Total for Question 7 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

END OF PAPER

(Turn over)

[illegible]

(Turn over)

Question Number	Additional pages, if required. Write the question number(s) in the left – hand margin.

[illegible]



GCE A LEVEL

2400U10-1

MONDAY, 13 MAY 2024 – MORNING

**BIOLOGY – AS UNIT 1
BASIC BIOCHEMISTRY
AND CELL ORGANISATION**

**The Diagram Booklet MUST be handed in
to the invigilators and sent for marking.**

Diagram Booklet

Surname: _____

First Name(s): _____

Centre Number: _____

Candidate Number: 2 _____

IMAGE 1.1

Bacterial cell

Animal cell

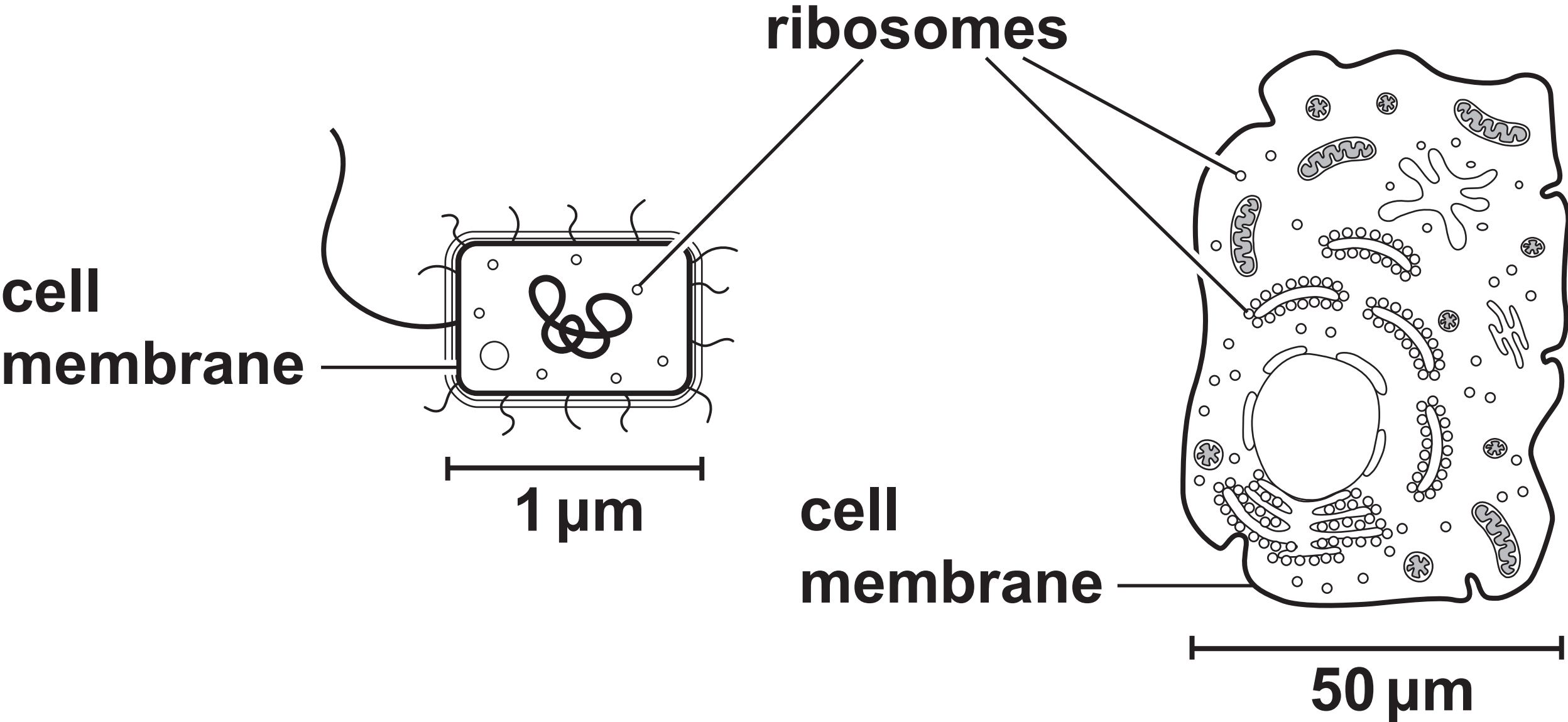


IMAGE 1.2

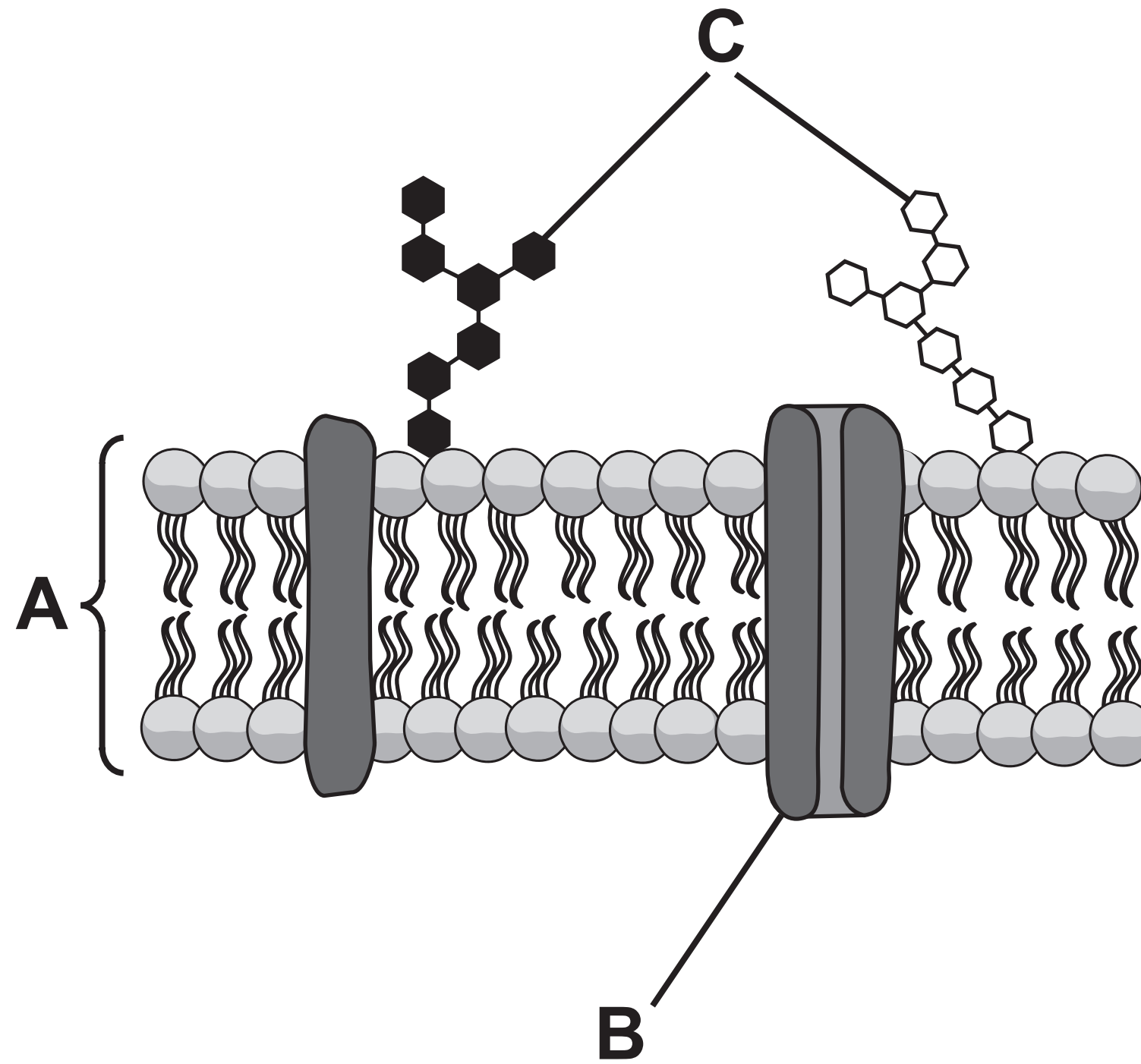
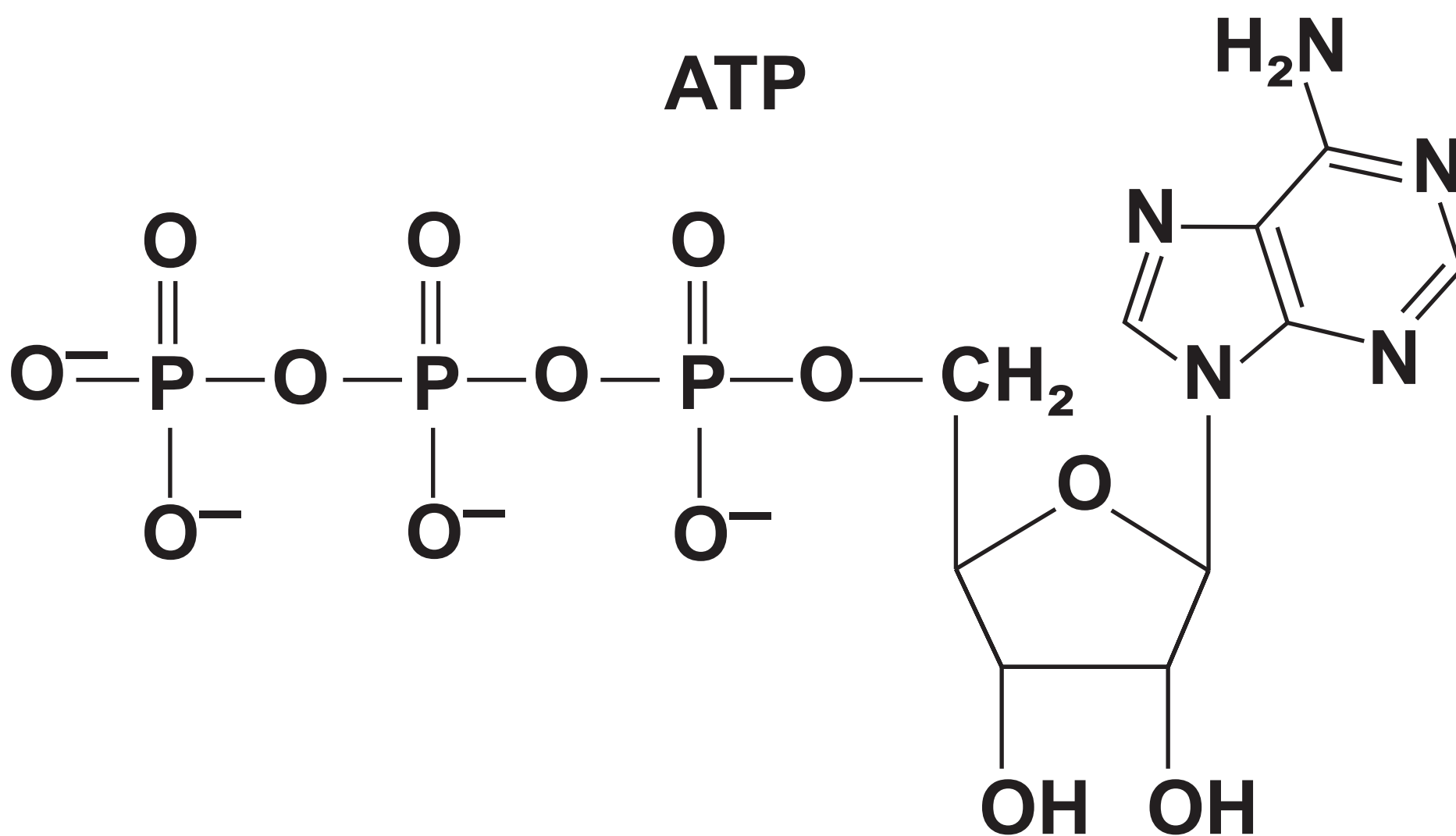


TABLE 1.3

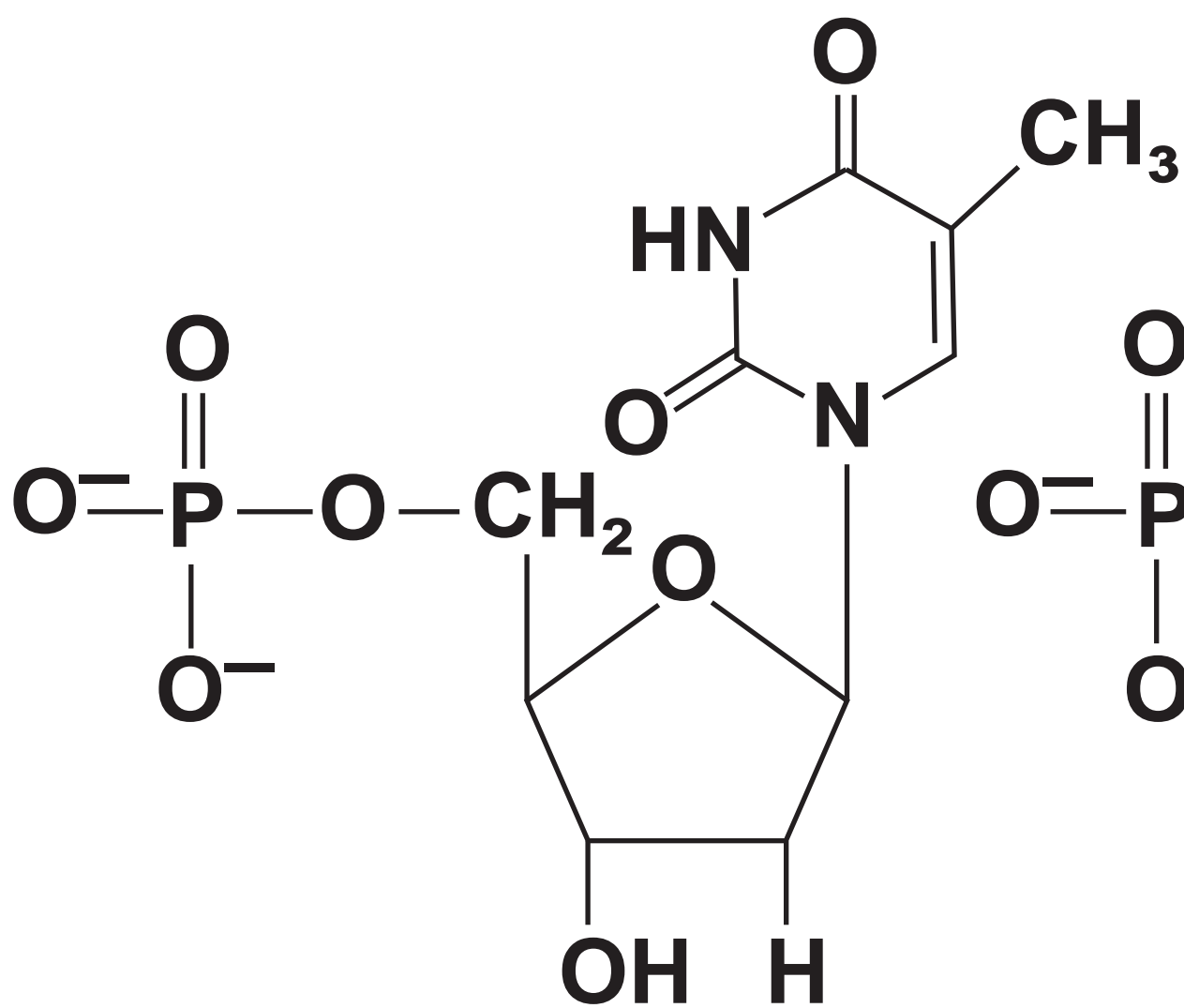
Membrane	Percentage composition (%)		
	Component A	Component B	Component C
animal cell surface membrane	53	42	5
inner mitochondrial membrane	22	78	0

IMAGE 2.1

ATP



DNA nucleotide



RNA nucleotide

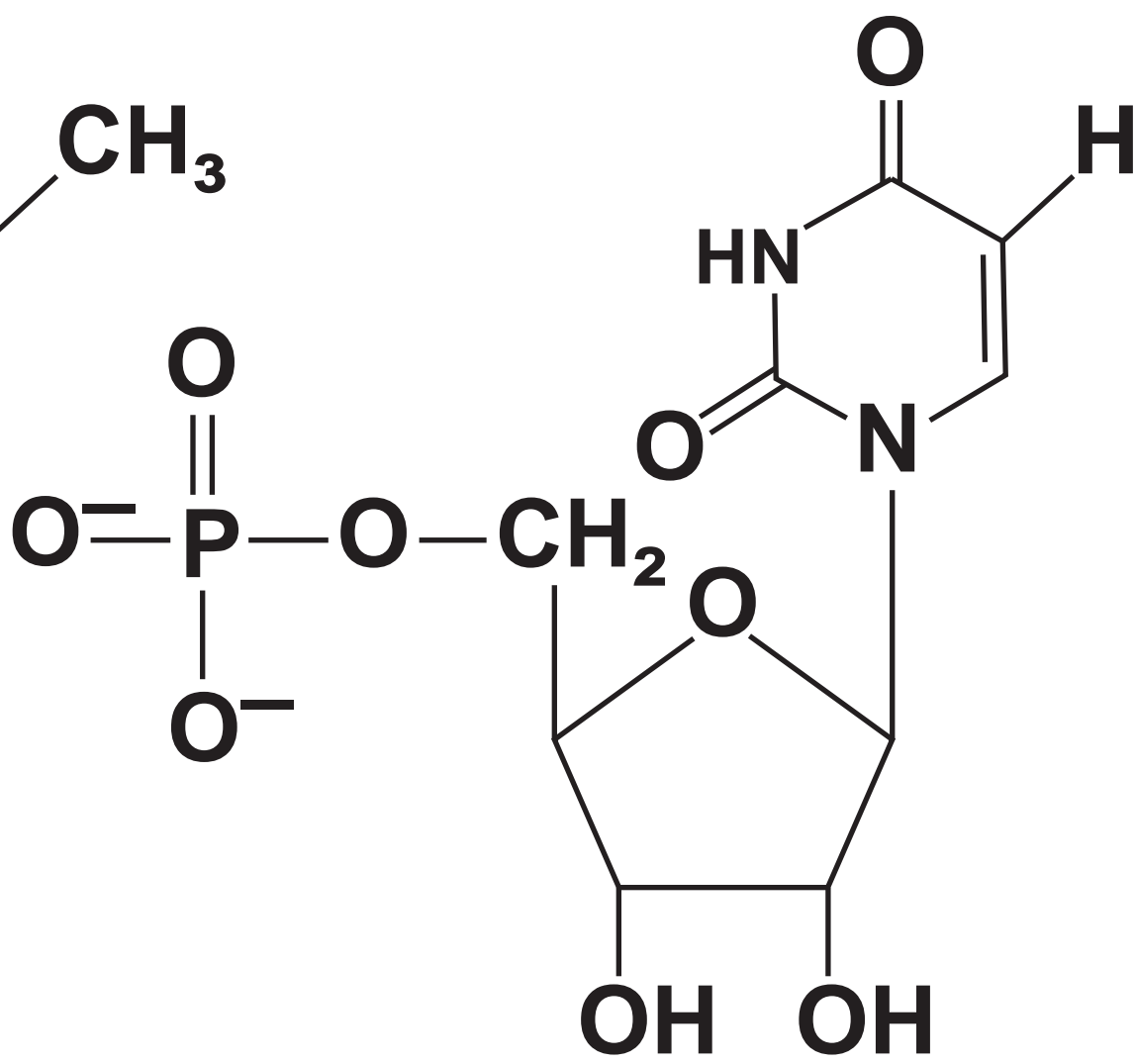


TABLE 2.2

Nucleotides	Difference
ATP AND RNA	
DNA AND RNA	

IMAGE 2.3

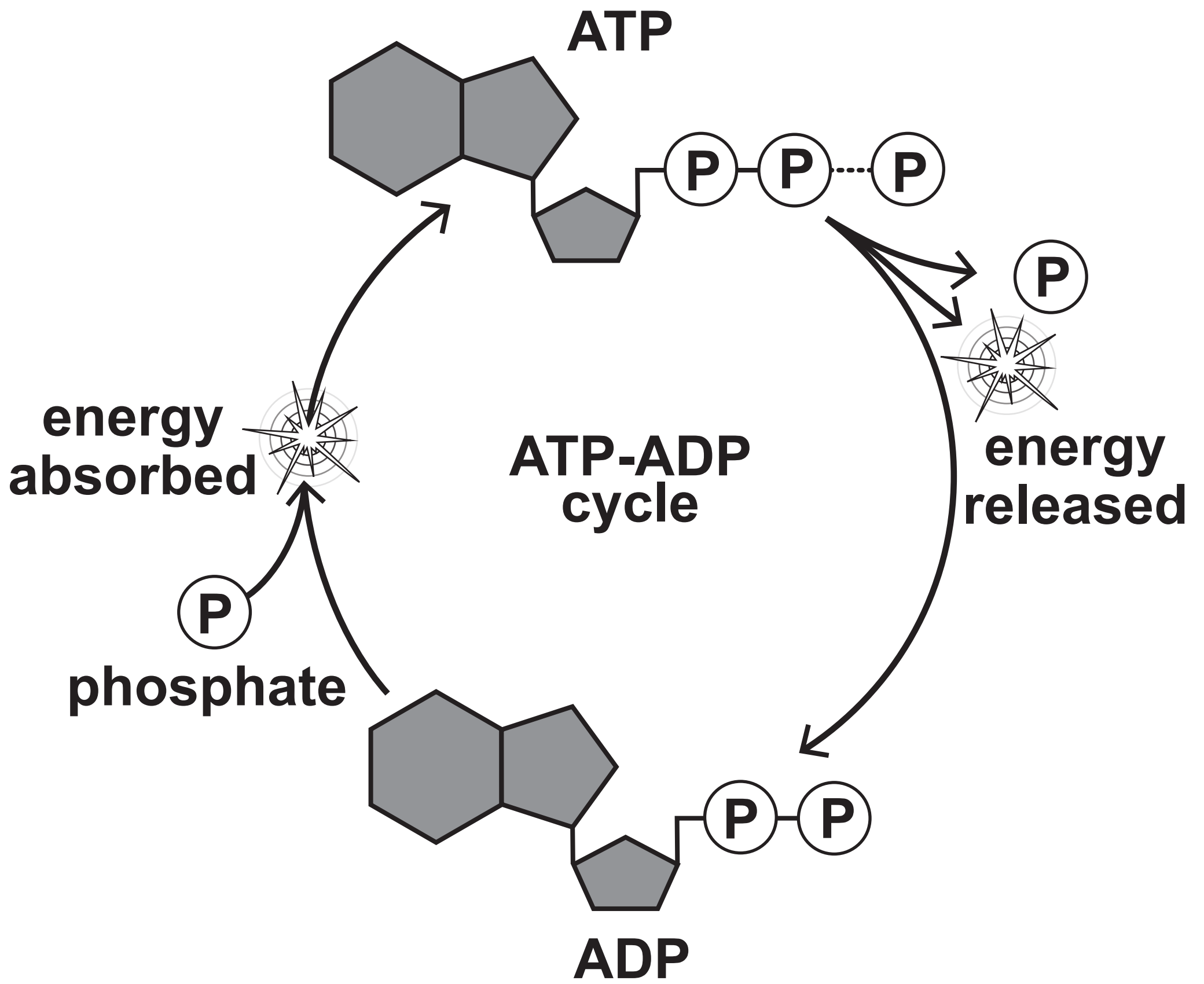


IMAGE 3.1

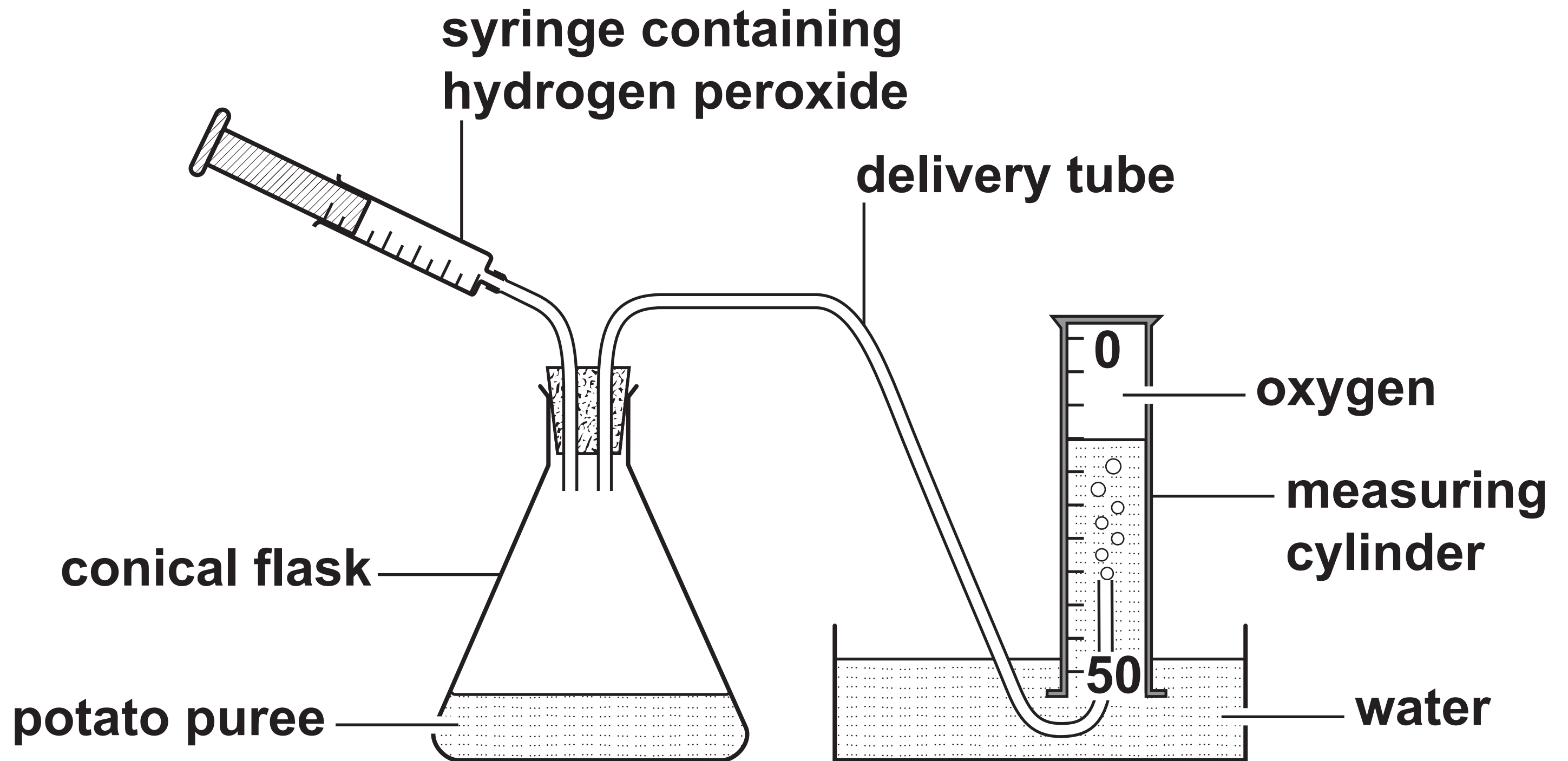


TABLE 3.2

Concentration of hydrogen peroxide (vol)	Volume of oxygen collected in 30 seconds (cm³)	Rate of oxygen production (cm³ s⁻¹)
0	0	0•0
1•0	18	0•6
1•5	26	_____
2•0	35	1•2
3•5	42	1•4
5•0	43	1•4

GRAPH 3.3

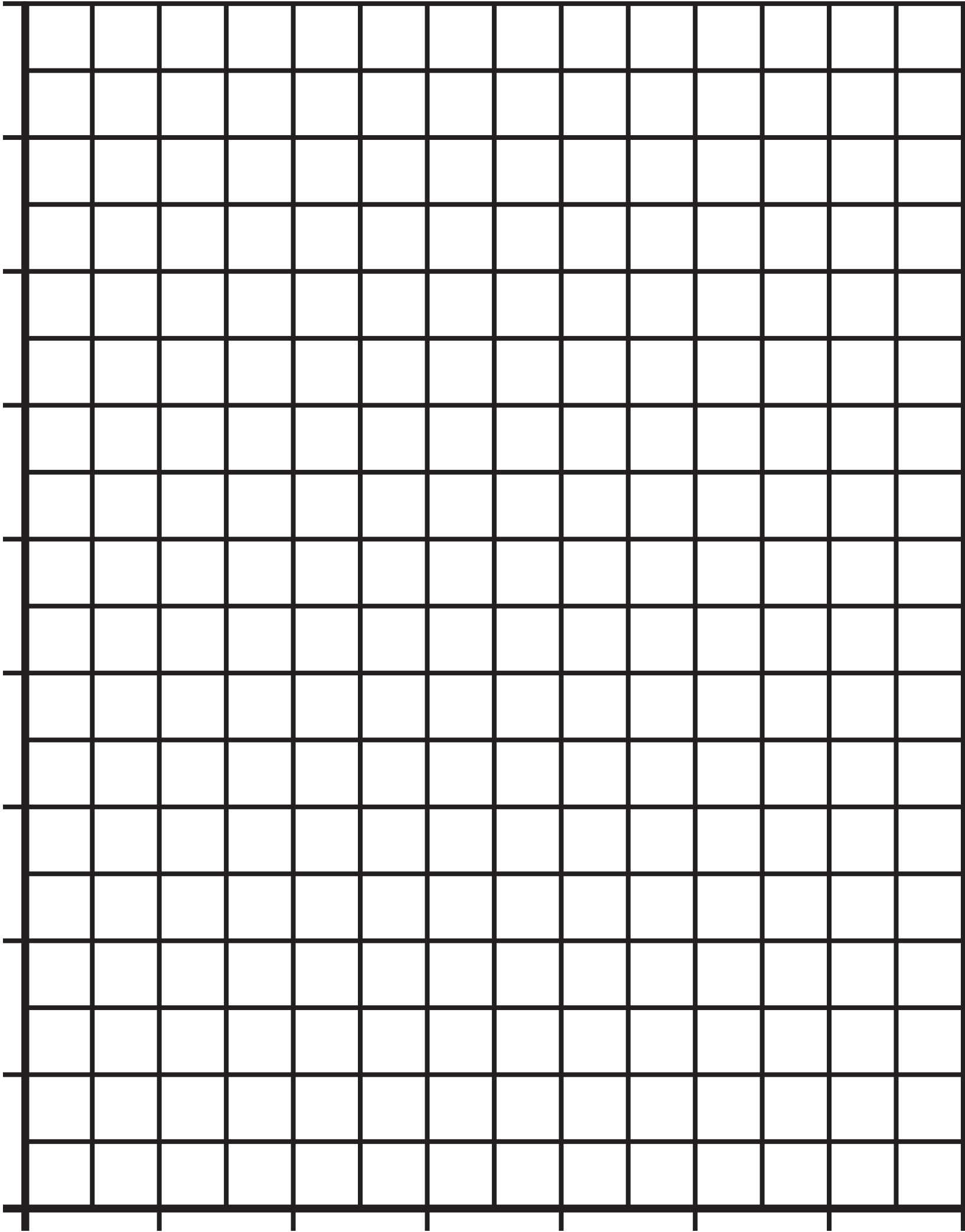


IMAGE 4.1

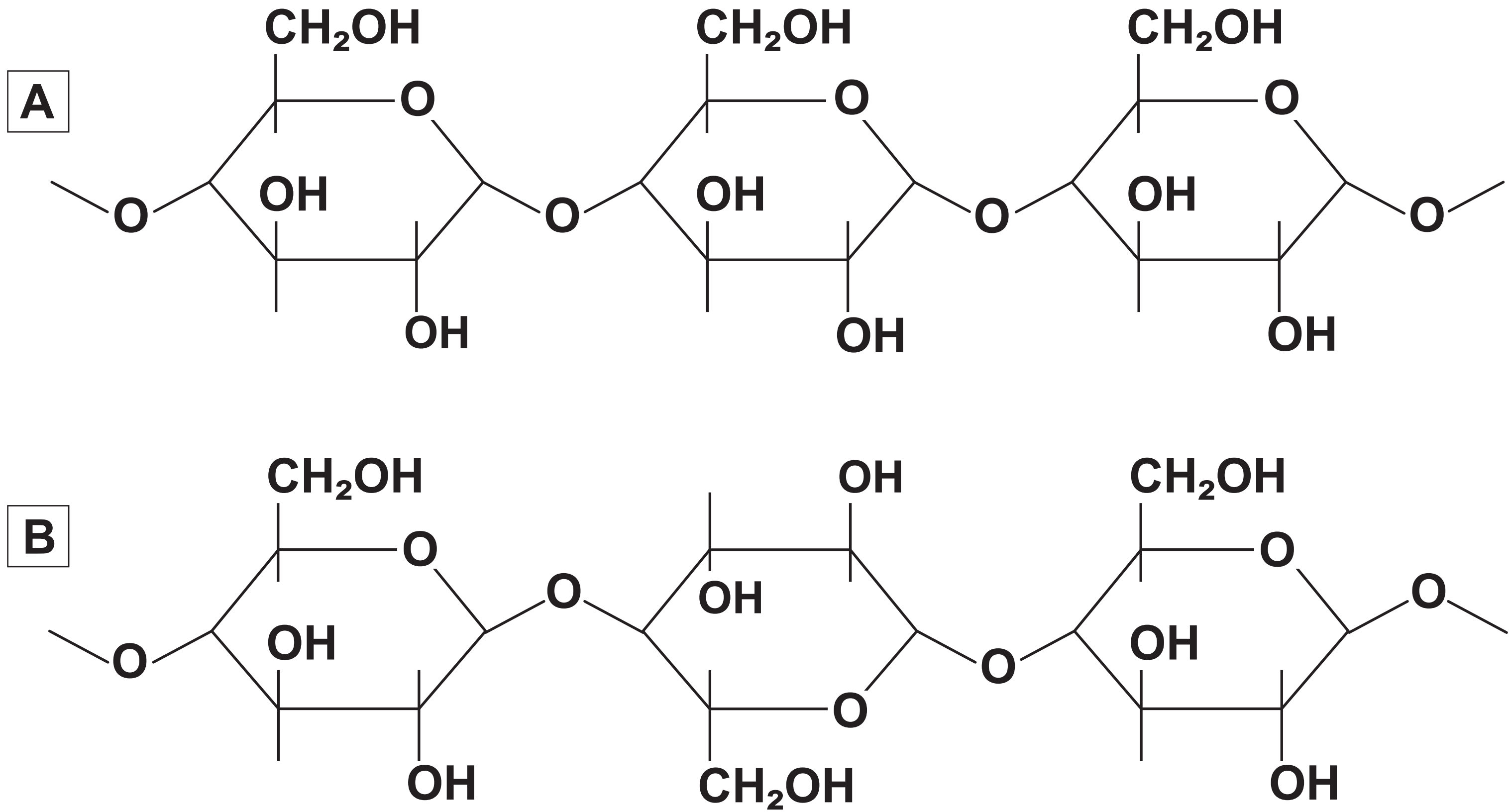


TABLE 4.2

	Polysaccharide A	Polysaccharide B
Name of polysaccharide		
Isomer of glucose present		
Description of structure		
Function in a plant cell		

IMAGE 4.3

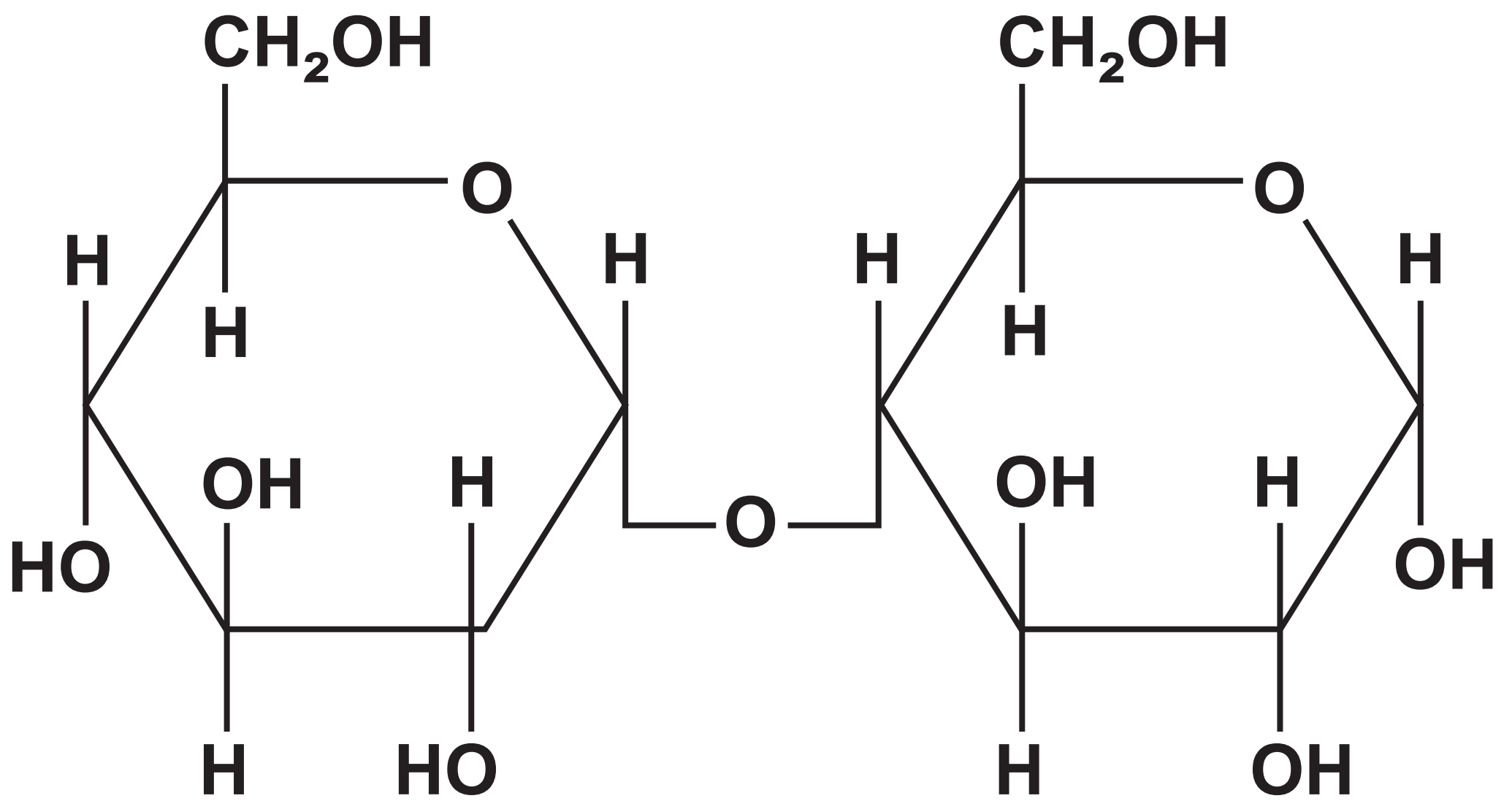


IMAGE 4.4

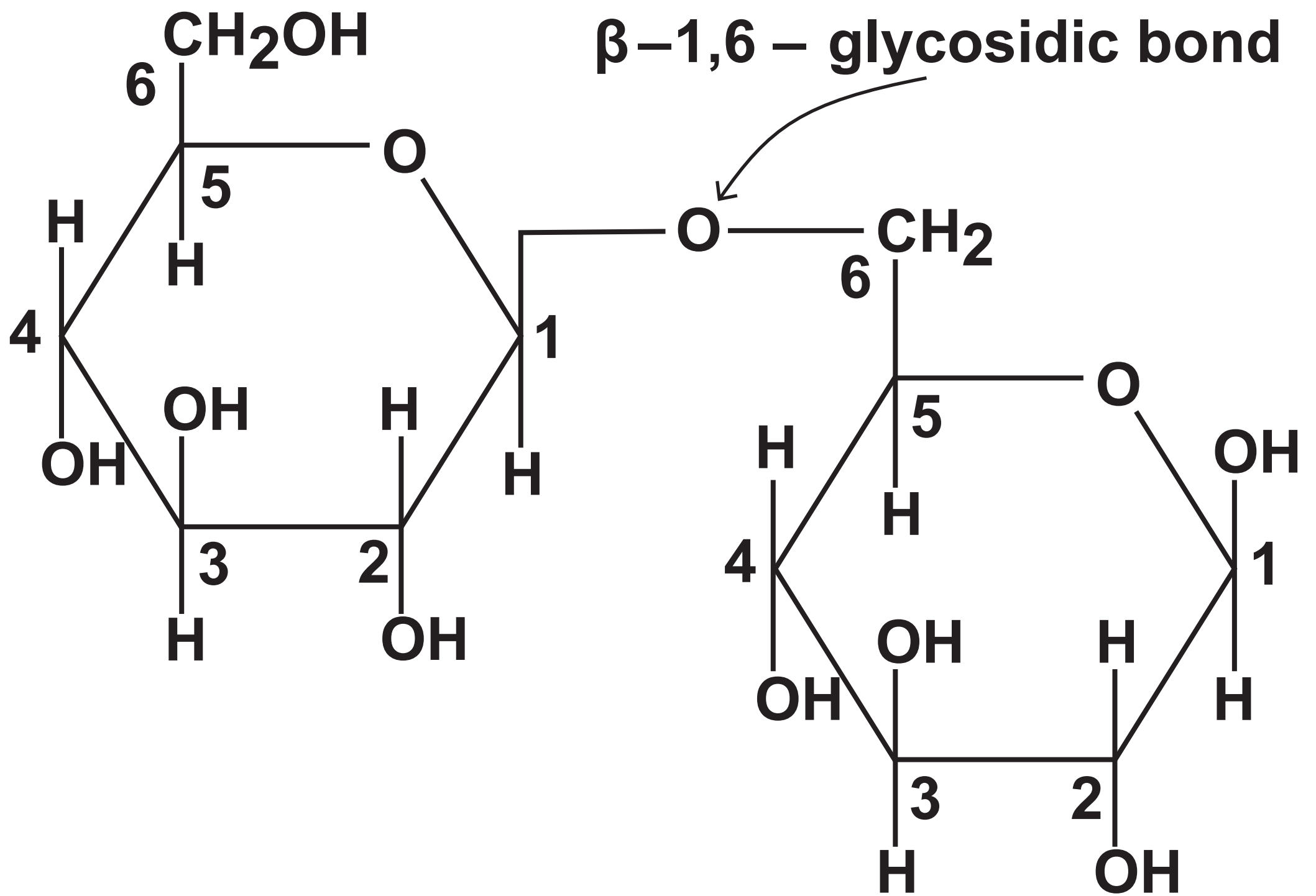


IMAGE 4.5

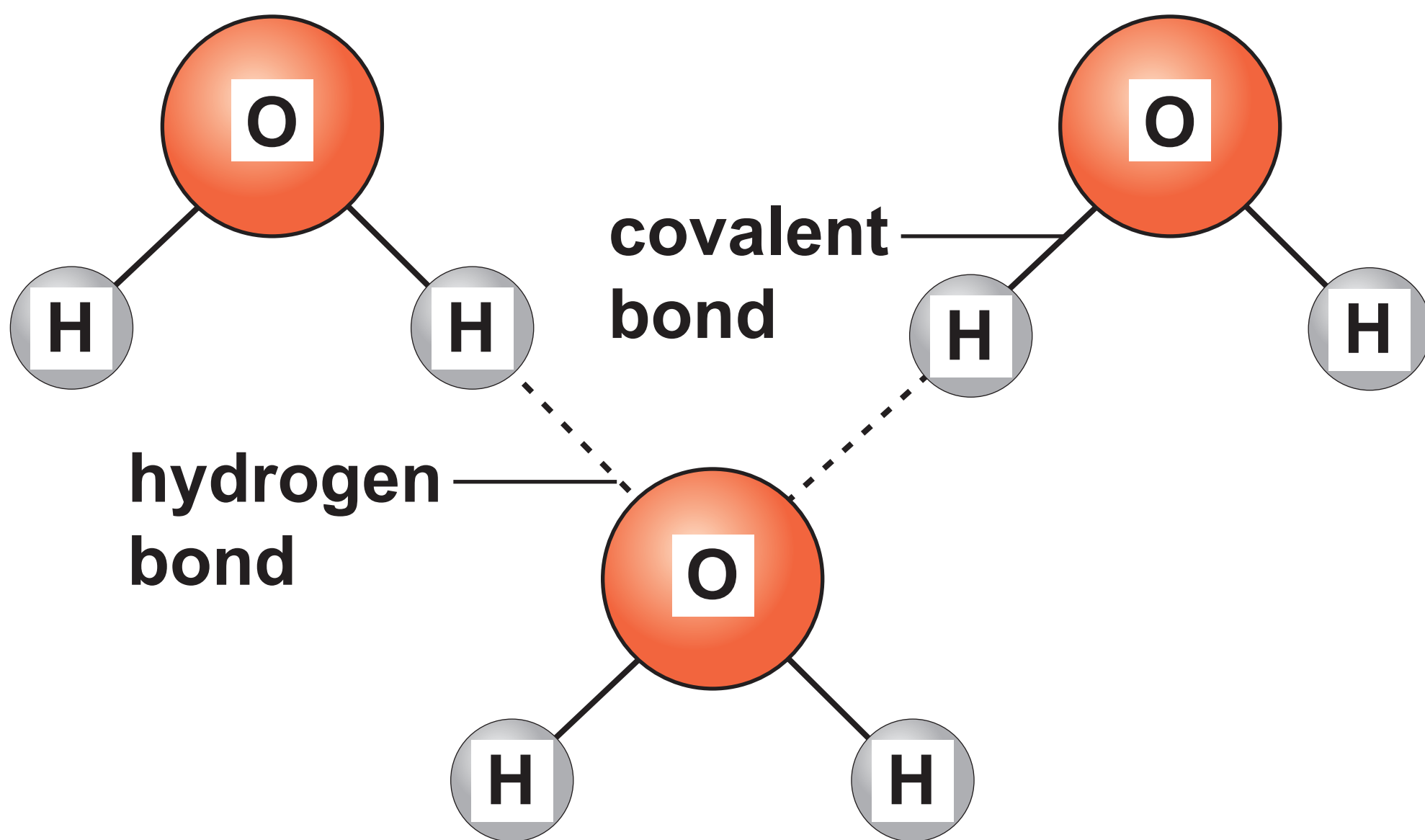


IMAGE 5.1

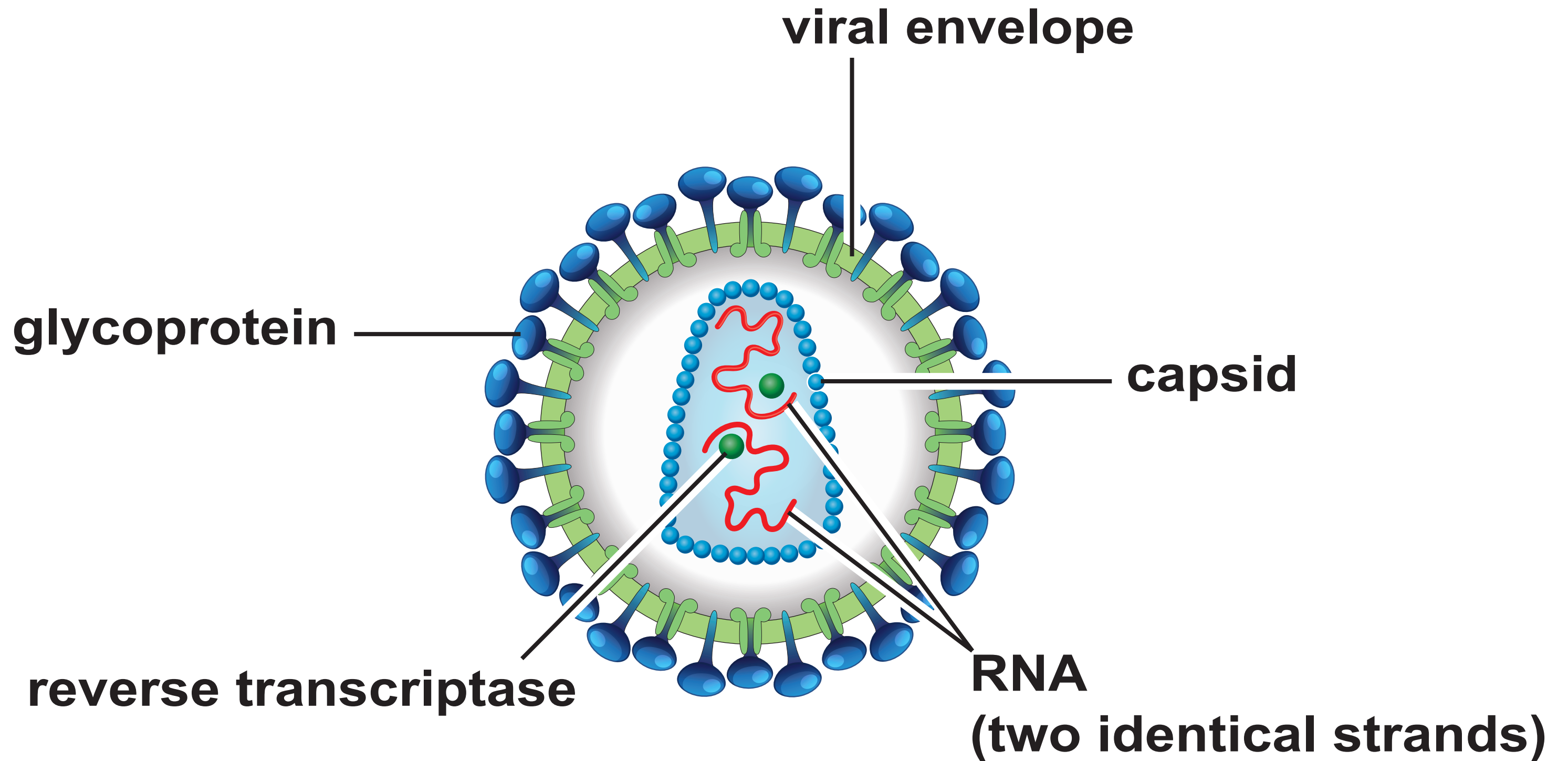


IMAGE 5.2

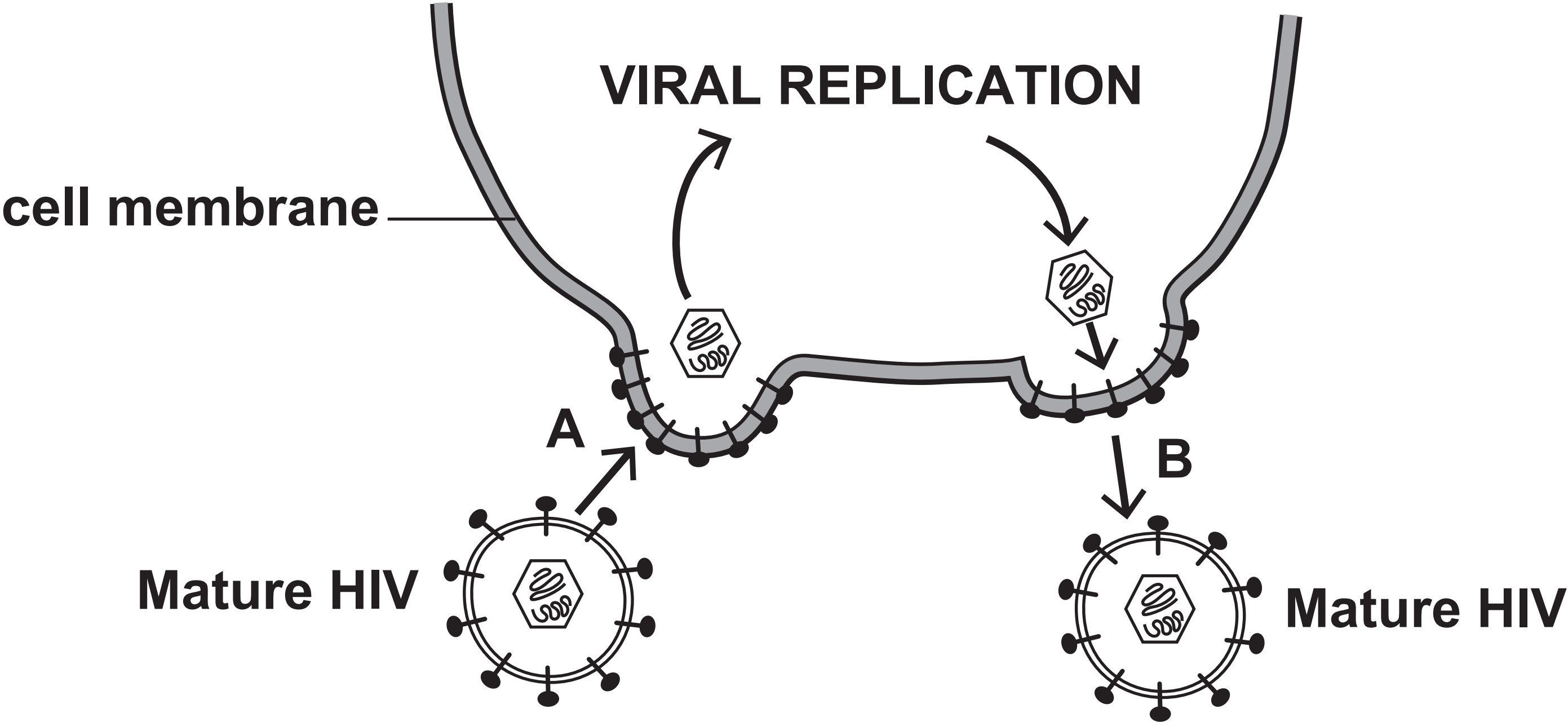


IMAGE 6.1

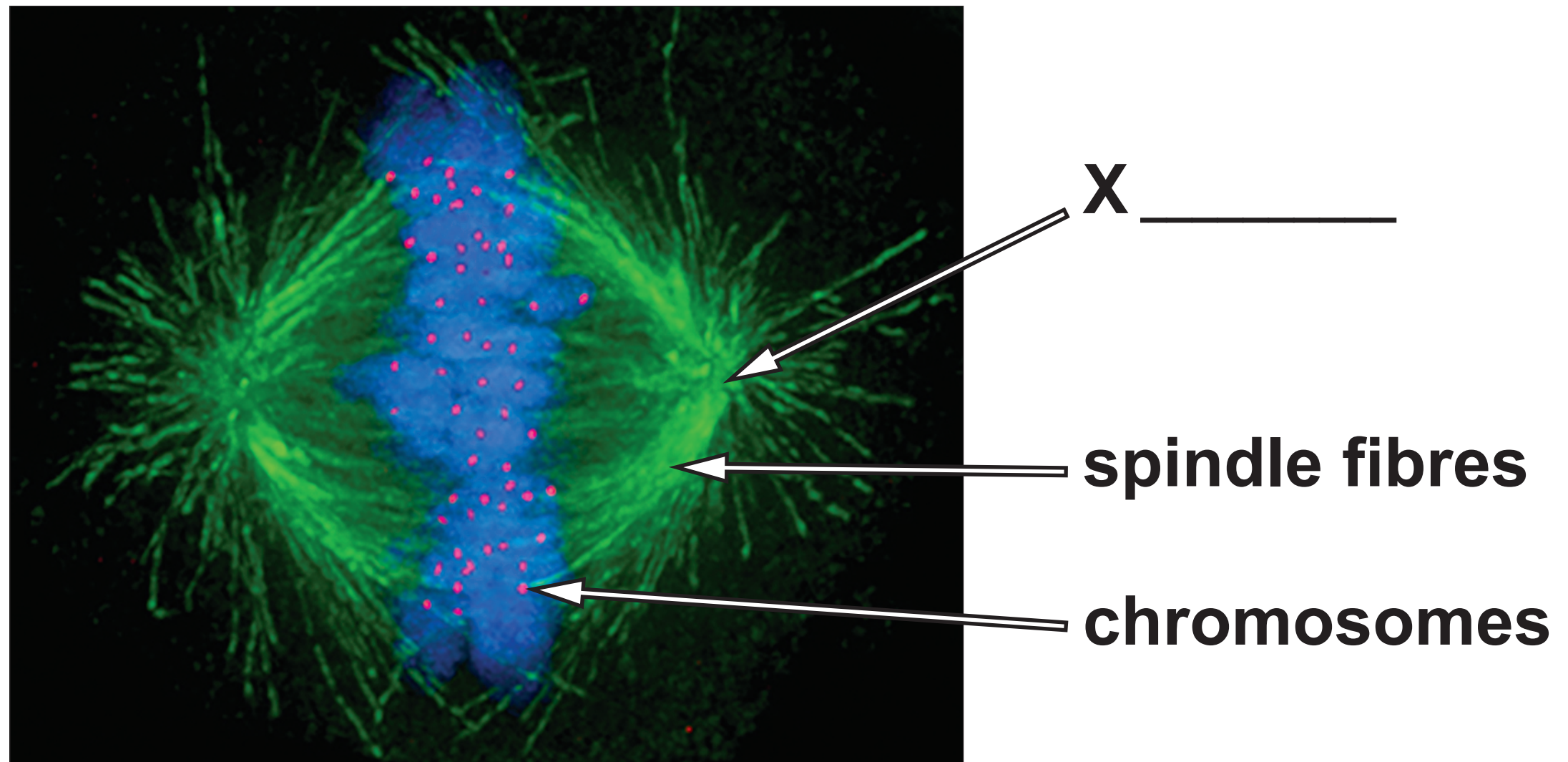


IMAGE 6.2

**tubulin
polypeptides**

microtubule

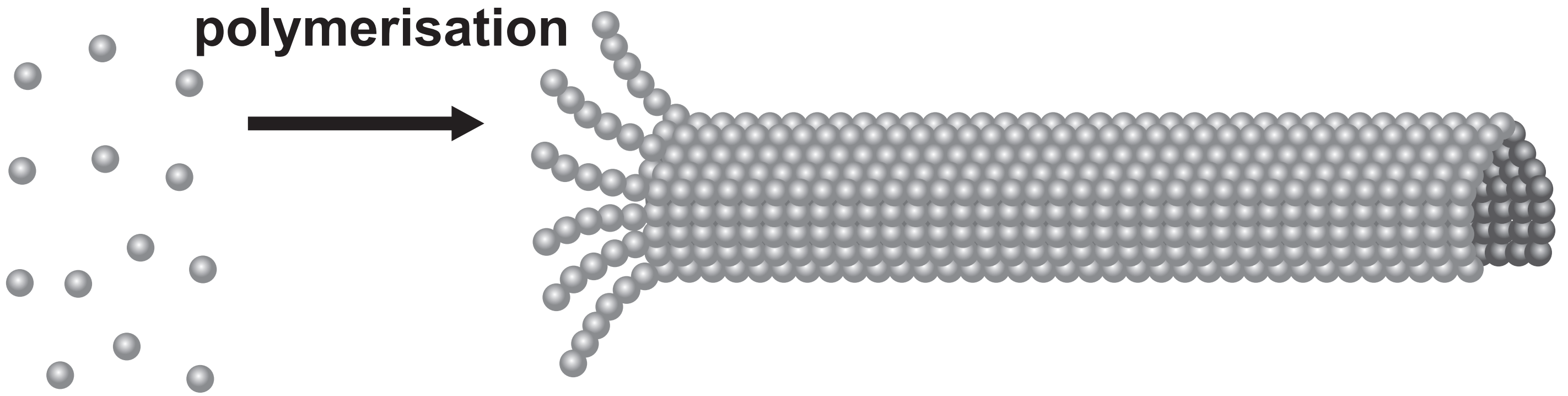
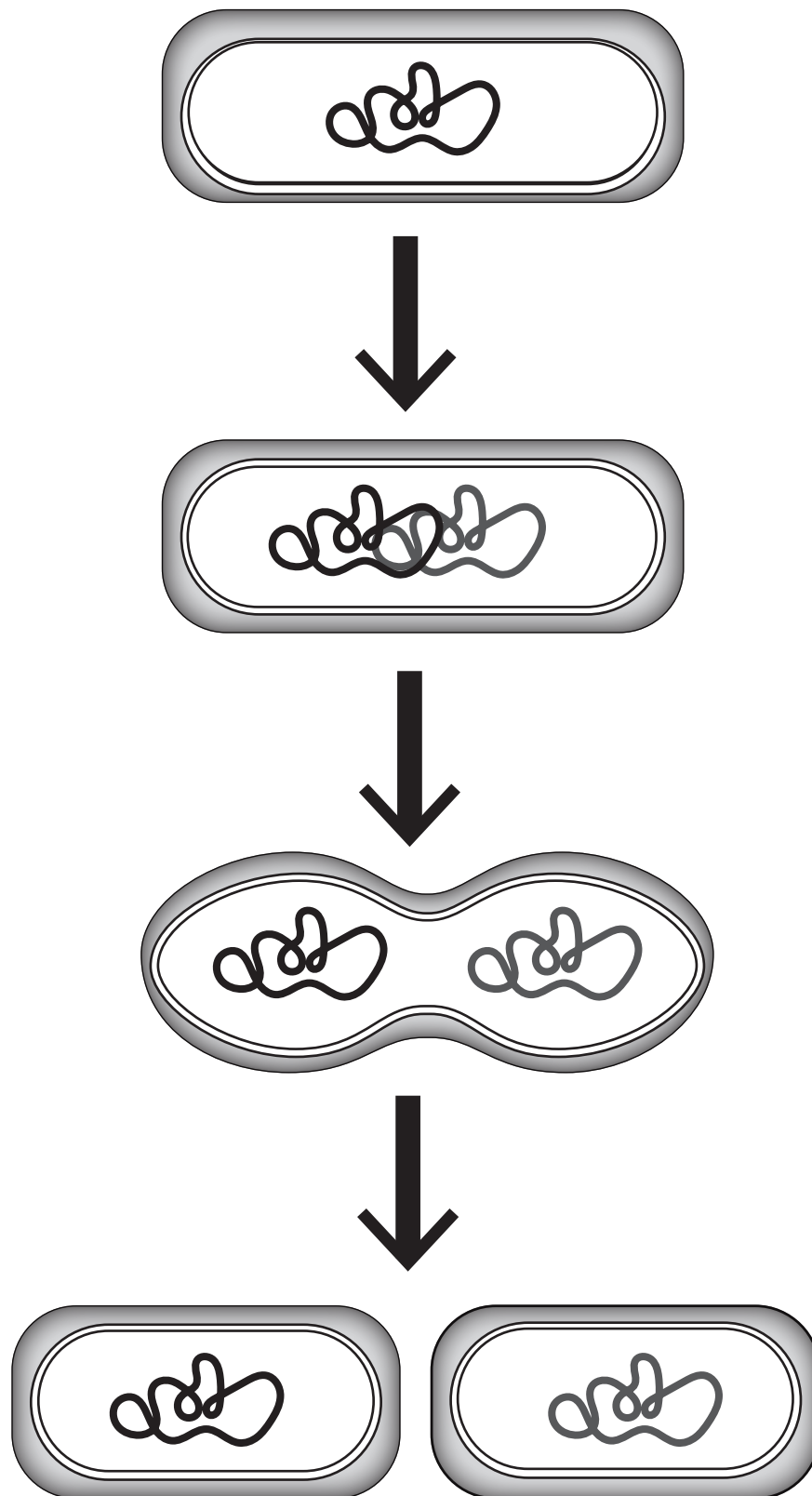


IMAGE 6.3



GRAPH 7

Key:

— potato
- - - sweet potato

